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EDITORIAL

Success of 2013–2020 World Health Organization action plan to control non-communicable diseases would require pollutants control

We are well aware that there is an ongoing epidemic of diabetes in Asian countries. The World Health Organization (WHO) also recognizes this fact and predicts the absolute number of deaths will be the highest among Asians, because the sheer numbers of patients are the largest. China and India are the key countries.

Still, I was shocked when I saw the report that diabetes prevalence in China reached 11.6% in 2010, and 50.1% of adult Chinese have prediabetes[1]. How could more than 60% of the adult population of a country become sick at the same time? Before 1980, diabetes prevalence was less than 1% in China. How could a rather rare disease become so prevalent within 30 years? We do not live in a late medieval age, when the Black Death (later known as the plague) killed approximately one-third of Europeans, but I believe the 21st century is different.

Although the report by Xu *et al.*[1] on the 2010 Chinese national survey used American Diabetes Association criteria for the diagnosis of diabetes (i.e., including the use of glycated hemoglobin as a diagnostic criteria of diabetes and cut-off value above 100 mg/dL in the diagnosis of impaired fasting glucose), which are known to increase the prevalence in comparison with the WHO criteria, readers will agree with experts of the American Diabetes Association and myself that those states are not healthy.

Diabetes and prediabetes do not kill people like the plague, but are still serious health problems that bring various cardiovascular complications. Acknowledging these facts and their seriousness, WHO has been promoting several action plans for the prevention and control of non-communicable diseases (NCDs), including diabetes, since 2000. In 2013, WHO published another 7-year action plan[2]. I found this plan did not differ a great deal from the previous 2008–2013 plan, which was developed from an earlier plan published in 2000. They all recommend that governments reduce the shared risk factors of NCDs among citizens, focusing on tobacco use, unhealthy (i.e., high fat) diet, physical inactivity and harmful use of alcohol. I believe those efforts were not very successful, as evidenced by the report of Xu *et al.*[1]

The new 2013–2020 action plan has expanded its arsenals and calls for strengthening the risk reduction measures, such as taxing tobacco, alcohol and sugary beverages, banning advertisements of unhealthy foods, and educating people to reduce salt intake. This action plan of over 100 pages long is very comprehensive and exhaustive in every detail.

However, I am afraid that this plan will fail again. I do not believe the diabetes epidemic in China occurred because Chinese people were lazy when they were achieving huge economic growth during the period of 2000–2010. They did not live a luxurious life either. They were not even obese when they became diabetic. The mean body mass index of Chinese diabetic patients reported in the 2010 survey was 23.7, and waist circumference was 80.2 cm.

I believe it will fail mainly because it did not consider the effects of increasing environmental pollution, and include the control measures for reducing exposure to pollutants. The production of chemicals has been shown to be closely associated with the rise of diabetes prevalence in the USA[3].

At time of writing, I am breathing polluted Seoul air, which contains a rather high amount of microparticles containing various chemical pollutants. Microparticle alerts are announced almost daily in Seoul. Particulate matter matters, as a recent *Science* article pointed out[4]. It is known to increase NCDs, including diabetes. According to the newspapers, environmental group reports and many other sources, we understand China is experiencing the worst environmental pollution ever in world history. I am sorry for my Chinese friends, although we Koreans had lived through a similar disastrous situation.

My Chinese friends should read the very compelling review by Lee *et al.*[5] showing that various persistent organic pollutants (POPs) are associated with obesity and diabetes. My fellow diabetologists would agree that, rather than a few individual POPs, background exposure to POP mixtures, including organochlorine pesticides and polychlorinated biphenyls, might increase diabetes. All those POPs might enter our body through foods, water and air. I agree with Lee *et al.*[5] that we require large prospective studies to prove this hugely important issue. The studies would need serial measurements of a broad range of POPs, adiposity and clinically-relevant biomarkers, and would need to develop laboratory tests that more closely mimic real-world POP doses, mixtures and exposure duration in humans, as suggested by the authors.

The 2013–2020 WHO action plan pointed out the pressing need to invest in NCD prevention as an integral part of sustainable socioeconomic development, and all-government responsibility of NCD prevention is stressed. However, it, more

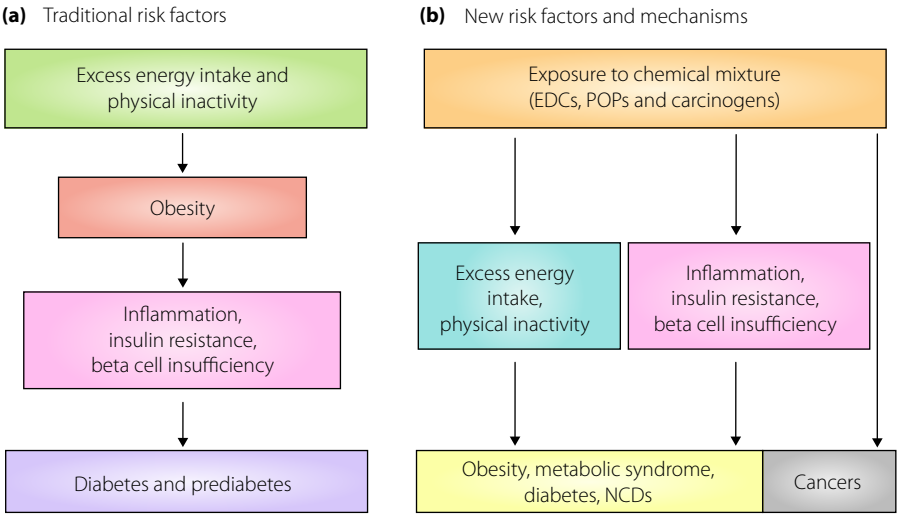

Figure 1 | (a) Traditionally accepted risk factors of diabetes and prediabetes, on which the World Health Organization (WHO) action plan 2013–2020[2] is based. (b) New risk factors and mechanisms suggested by Lee *et al.*[5] and WHO in collaboration with the United Nations Environmental Program[6]. For the successful prevention of diabetes mellitus and related non-communicable diseases (NCDs), WHO should consider new risk factors, and invest in further development of this concept and make plan B. EDCs, endocrine disrupting chemicals; POPs, persistent organic pollutants.

specifically NCD experts consulting for WHO, did not pay enough attention to the health effects of environmental pollutants.

Then I found an interesting report by WHO, made in collaboration with the United Nations Environmental Program, which recommended improving human and wildlife health by preventing environmentally-induced diseases, which include insulin resistance[6]. Its recommendation calls for strengthening knowledge of endocrine-disrupting chemicals, improved testing for endocrine-disrupting chemicals, reducing exposures and thereby vulnerability to disease, identifying endocrine active chemicals, creating enabling environments for scientific advances, innovation and disease prevention, and methods for evaluating evidence, just as recommended by Lee *et al.*[5]

Figure 1 shows two basic concepts, traditional risk factors of diabetes (Figure 1a) on which the current WHO action plan is based, and newly proposed risk factors and mechanisms of diabetes and related conditions (Figure 1b), which I wish WHO to consider. Although the intervention on traditional risk factors with diet and physical activities, or plan A, was proven effective at a population level, all the studies compared two groups within a society. It is possible that increasing environmental pollution in a society, the introduction of new risk factors, if not treated with a new plan might destroy the potential benefits from plan A.

I sincerely hope WHO could amend its ambitious action plan to reduce NCDs by the taking recommendations of many scientists, civilians and other organizations, including its own.

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